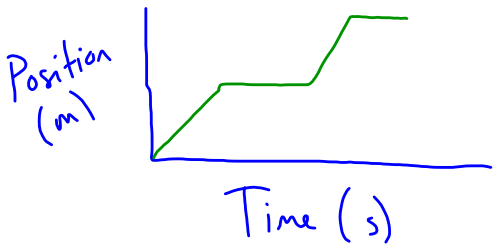
Position v. Time Graphs:

- Position
  - Distance → always positive
  - Displacement → can be positive or negative, depending on your starting point
  - Either distance or displacement on the y-axis
- Time
  - X-axis
  - Always increases
- Example



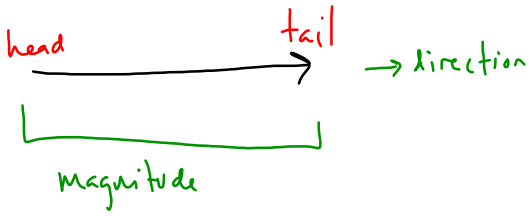
- Slope = $\frac{\text{position}}{\text{time}}$ = speed velocity
  - Steeper the slope, the faster the object is moving.
  - Slope of ∅ means object is not moving.

Scalars v. Vectors

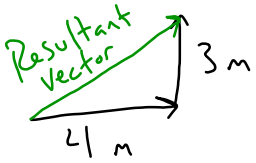
- Scalar → measurement that has only "how much"
- Vector → measurement that has both "how much" and "what direction"
  - Magnitude = "how much"
- Scalar examples:
  - Time
  - Distance
  - Speed
  - Weight
- Vector examples:
  - Displacement (scalar part is distance)
  - Velocity (scalar part is speed)
  - Acceleration

Vector Addition:

- We draw vectors as arrows.
  - Length of arrow = magnitude
  - Direction of arrow = direction
- Adding vectors
  - Place them head to tail

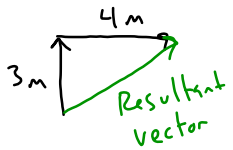


  - We are allowed to move (translate) vectors, but we cannot change either magnitude or direction.
- Process of adding vectors:



Resultant vector is drawn from head of 1st vector to tail of last vector

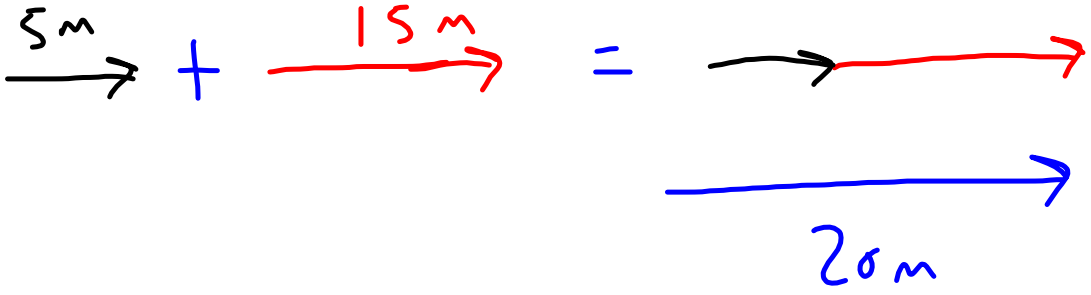
  - Order of addition does not matter

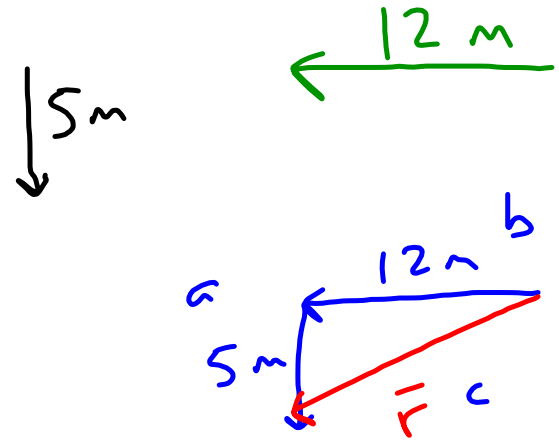


  - To find magnitude of resultant vector, use Pythagorean theorem

$a^2 + b^2 = c^2$ for us, the "c" term is our resultant vector

Vector Addition Examples:

1. 

2. 

Notation:

$\bar{r}$ = vector "r"

$$a^2 + b^2 = c^2$$

$$\sqrt{(5m)^2 + (12m)^2} = \sqrt{c^2}$$

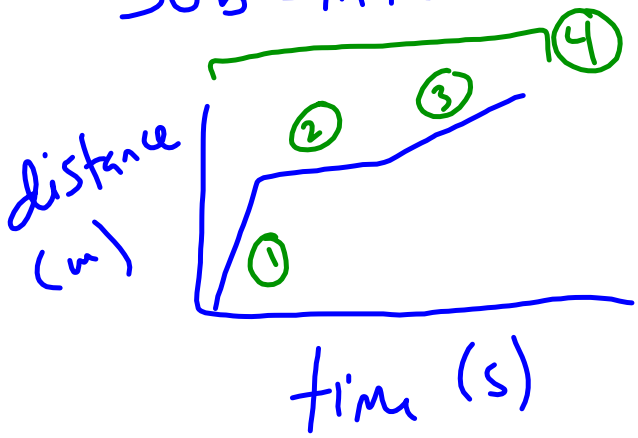
$$c = 13m$$

$\bar{r}$ = 13 m southwest

Equations:

- $\text{speed} = \frac{\text{distance}}{\text{time}}$ $\quad s = \frac{d}{t}$

  - Calculate for various intervals
    - Overall interval
    - Sub-intervals within total time



- $\overline{\text{Velocity}} = \frac{\text{displacement}}{\text{time}}$ $\quad \bar{v} = \frac{\bar{d}}{t}$